National Institute of Environmental Health Sciences

Critical review of mercury fates and contamination in the arctic tundra ecosystem

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Abstract:

Mercury (Hg) contamination in tundra region has raised substantial concerns, especially since the first report of atmospheric mercury depletion events (AMDEs) in the Polar Regions. During the past decade, steady progress has been made in the research of Hg cycling in the Polar Regions. This has generated a unique opportunity to survey the whole Arctic in respect to Hg issue and to find out new discoveries. However, there are still considerable knowledge gaps and debates on the fate of Hg in the Arctic and Antarctica, especially regarding the importance and significance of AMDEs vs. net Hg loadings and other processes that burden Hg in the Arctic. Some studies argued that climate warming since the last century has exerted profound effects on the limnology of High Arctic lakes, including substantial increases in autochthonous primary productivity which increased in sedimentary Hg, whereas some others pointed out the importance of the formation and postdeposition crystallographic history of the snow and ice crystals in determining the fate and concentration of mercury in the cryosphere in addition to AMDEs. Is mercury re-emitted back to the atmosphere after AMDEs? Is Hg methylation effective in the Arctic tundra? Where the sources of MeHg are? What is its fate? Is this stimulated by human made? This paper presents a critical review about the fate of Hg in the Arctic tundra, such as pathways and process of Hg delivery into the Arctic ecosystem; Hg concentrations in freshwater and marine ecosystems; Hg concentrations in terrestrial biota; trophic transfer of Hg and bioaccumulation of Hg through food chain. This critical review of mercury fates and contamination in the Arctic tundra ecosystem is assessing the impacts and potential risks of Hg contamination on the health of Arctic people and the global northern environment by highlighting and "perspectiving" the various mercury processes and concentrations found in the Arctic tundra.

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Resource Description

Exposure : ☒

weather or climate related pathway by which climate change affects health

Food/Water Quality

Food/Water Quality: Chemical, Other Food Quality

Food Quality (other): Mercury levels in wildlife and vegetation

Geographic Feature: ☒

resource focuses on specific type of geography

Arctic, Ocean/Coastal

Geographic Location: ☑

resource focuses on specific location

Global or Unspecified, Non-United States

Non-United States: Asia, Europe, Non-U.S. North America

Asian Region/Country: Other Asian Region

Other Asian Region: bordering the Arctic Ocean

European Region/Country: European Region

Other European Region: bordering the Arctic Ocean

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Neurological Effect

Resource Type: ☑

format or standard characteristic of resource

Review

Timescale: ☑

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment: ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content